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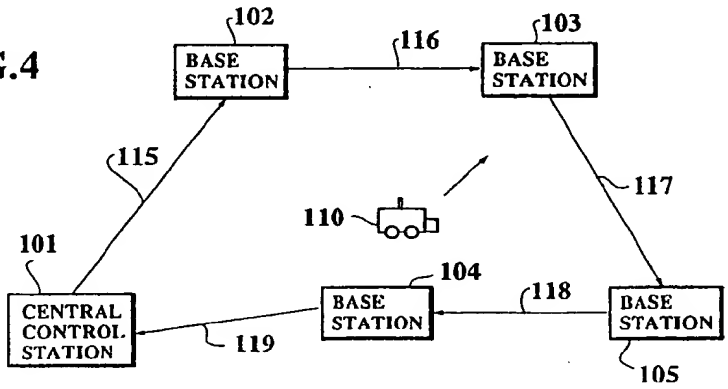
(54) Method of handover and route diversity in mobile radio communication.

(57) A method of handover and route diversity in a mobile radio communication which is less time consuming and capable of improving the frequency spectrum utilization efficiency and securing the high quality of service regardless of the moving speed of the mobile station. In the method, a loop transmission line (115 to 119) by which each base station (102 to 105) is connected with neighboring base stations is provided; a handover information is transmitted through the loop transmission line (115 to 119), where the handover information is relayed by each base station from one of the neighboring base stations to another one of the neighboring base station; and the handover of a communication of a mobile station (110) from one traffic channel of one base station to an idle traffic channel of another base station is carried out by using the handover information transmitted through the loop transmission line (102 to 105). The method can also be applied to a route diversity reception.

FIG.4



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DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X	IEEE COMMUNICATIONS MAGAZINE. vol. 27, no. 7, July 1989, US pages 20 - 29; STEELE: 'The Cellular Environment of Lightweight Handheld Portables'	1-8,18, 19	H04Q7/04 H04B7/26 H04B7/02
A	* page 22, right column, line 17 - line 19 * * page 23, right column, line 1 - page 24, right column, line 20; figures 3,4 *	9-15,21, 22,25	
A	GB-A-2 138 652 (STANDARD TELEPHONES AND CABLES PUBLIC LIMITED COMPANY) * page 1, line 22 - line 43 * * page 1, line 76 - line 96 * * page 2, line 42 - line 61 * * page 3, line 79 - page 4, line 29 * * figures 1,2 *	26,27,30	
A	DE-A-3 210 298 (ROBERT BOSCH GMBH) * page 7, line 5 - page 8, line 31 *	26,27,30	

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	16 SEPTEMBER 1992	BEHRINGER L.V.

CATEGORY OF CITED DOCUMENTS

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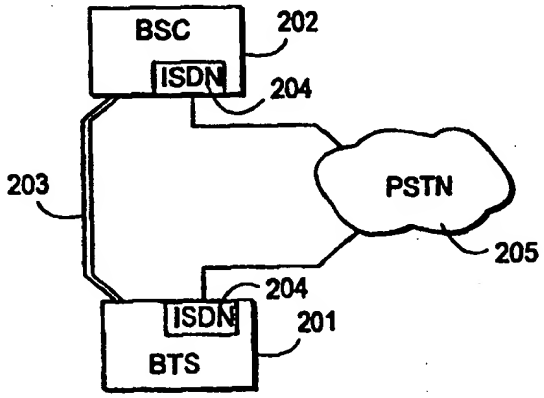
(54) Title: IMPLEMENTATION OF ADDITIONAL AND/OR BACKUP CAPACITY IN BASE STATION TRANSMISSION

(57) Abstract

A base station subsystem in a cellular radio system comprises as telecommunication apparatus base transceiver stations (201, 301, 302, 303, 304, 301', 304', 401, 402, 403, 404) and a base station controller (202, 306, 405) as well as a transmission system (203, 305, 406) to realize data communication between the telecommunication apparatus. A telecommunication apparatus comprises a transmission unit (307, 506, 603) to connect it with the transmission system. It also comprises an interface (204, 308, 508, 605) to a public switched telephone network (205, 509) in order to realize data communication between it and a second telecommunication apparatus in the base station subsystem via the public switched telephone network. The telecommunication apparatus is adapted so as to operate in at least two mutually alternative states (701, 702, 703) with respect to the communication between it and the second telecommunication apparatus. In the first state (701) a connection via the public switched telephone network between said two telecommunication apparatus in the base station subsystem is not in use, and in the second state (702, 703) a connection via the public switched telephone network between said two telecommunication apparatus in the base station subsystem is in use.



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Implementation of additional and/or backup capacity in base station transmission

The invention relates to the realization of data communication between a base transceiver station and other network elements in a cellular radio system.

A base station subsystem (BSS) in a digital cellular radio system comprises base transceiver stations (BTS) and a base station controller (BSC) which controls several base transceiver stations simultaneously. Fig. 1 shows a known base station subsystem which comprises a base station controller 100 and three base transceiver stations 101, 102 and 103. In the system depicted, the communications links between the base station controller 100 and base transceiver stations 101, 102 and 103 are realized using the so-called star topology where separate communications links branch at the base station controller100 to each of the base transceiver stations 101, 102 and 103. Other known connection topologies include the tree topology, in which a trunk line starting from the base station controller branches from a base transceiver station to another, and the ring topology in which the base transceiver stations and the base station controller are interconnected so as to form a ring-like system. Various combinations and modifications of these basic topologies are also used. A system that provides for the internal communications links in a base station subsystem is called a transmission system. The base transceiver stations and base station controller may be called collectively telecommunication apparatus in the base station subsystem.

Physically the communications links in a transmission system may be wired links, fiber-optic cable links, directional microwave links or combinations of these. In areas with a high density of base transceiver stations and heavy loading on the cellular radio system, sufficient cable and/or microwave link capacity should be reserved for the transmission system's communications links to realize a transmission network dedicated for that particular purpose. In a known implementation the bit rate of the transmission system is 2048 kbps or its multiple, and its capacity is time-divided into 32 time slots which may be allocated to base transceiver stations in variable quantities. If however a base transceiver station is located very far away from the base station controller, or traffic via that base transceiver station is at a low level, it may be more cost-effective to use a ready-built communications system such as the ISDN (Integrated Services Digital Network) to realize a data connection between the base transceiver station and base station controller. Finnish Patent Ap-

plication FI-940034 discloses an arrangement for using an ISDN link for the communication between base transceiver stations and a base station controller.

The problem with the transmission systems according to the prior art is the difficulty of dimensioning the capacity such that on the one hand, there will be enough capacity for peak traffic but, on the other hand, extra capacity should not result in unnecessary costs for the operator responsible for the operation of the cellular radio system. The problem of extra capacity is aggravated if it is required that the transmission system shall have redundant communications capacity in case an individual link fails.

An object of the present invention is to provide a method and apparatus for realizing the internal data communication in a base station subsystem in such a manner that the disadvantages of the prior art described above are avoided. Another object of the invention is to provide a method and apparatus for realizing data communication in a flexible manner adaptable to various communications needs.

The objects of the invention are achieved by using as a redundant and/or additional capacity another digital transmission path, preferably an ISDN connection.

A base station subsystem according to the invention is characterized in that it comprises in at least two telecommunication apparatus an interface to a public switched telephone network in order to realize data communication between said two telecommunication apparatus, whereby these two telecommunication apparatus, as regards their mutual communication, are adapted so as to function in at least two mutually alternative states in the first of which the connection between these two telecommunication apparatus via the public switched telephone network is not in use, and in the second of which the connection between these two telecommunication apparatus via the public switched telephone network is in use.

The invention is also directed to a base transceiver station and base station controller which are characterized in that they comprise an interface to a public switched telephone network in order to realize data communication via the public switched telephone network between telecommunication apparatus of a base station subsystem, whereby they are adapted so as to function, as regards their mutual communication, in at least two mutually alternative states in the first of which the connection via the public switched telephone network is not in use, and in the second of which the connection via the public switched telephone network is in use.

Furthermore, the invention is directed to a method for realizing data communication in a base station subsystem. The method according to the invention is characterized in that the functional state of the mutual communication of at least two telecommunication apparatus is switched between at least two mutually alternative states in the first of which there is no data connection between these two telecommunication apparatus via a public switched telephone network, and in the second of which there is a data connection between these two telecommunication apparatus via a public switched telephone network.

In accordance with the invention, a dedicated transmission system and the use of a connection provided by a public telecommunication network are not mutually exclusive options for the internal data communication in a base station subsystem but they can be used to complement each other. A base transceiver station and base station controller may comprise means for establishing a mutual ISDN connection or another suitable connection when needed, e.g. when the need for capacity exceeds a predetermined limit value or when data communication via another route has been temporarily prevented. Since such a connection is used only when needed, it causes no unnecessary operating costs.

One connection type which is especially well suited to be used in accordance with the invention is an ISDN connection. In that case the base transceiver station and base station controller have an ISDN basic-rate connection through which they can be connected to an ISDN local exchange. The establishment, use and termination of the connection are carried out in the same way as in the case of an ordinary digital telephone connection. An ISDN basic-rate connection uses two 64-kbps traffic channels and one 16-kbps signaling channel. Especially in a base station controller it may be more advantageous to use an ISDN system connection which has the speed of 2048 kbps and to which several traffic and control channels can be connected. Then the base station controller may have simultaneous ISDN connections with a plurality of base transceiver stations.

The invention is below described in more detail referring to the preferred embodiments presented by way of example and to the attached drawing in which

Fig. 1 shows a known base station subsystem,
Fig. 2 illustrates the principle of the invention,
Fig. 3a shows an application of the invention in a base station subsystem,

Fig. 3b shows a second application of the invention in a base station subsystem,
Fig. 4 shows a third application of the invention in a base station subsystem,
Fig. 5 shows a base transceiver station according to the invention,
Fig. 6 shows a base station controller according to the invention, and
Fig. 7 illustrates in the form of state diagram an embodiment of the method according to the invention.

Above in connection with the description of the prior art reference was made to Fig. 1, so below in the description of the invention and its preferred embodiments reference will be made mainly to Figs. 2 to 7. Like elements in the drawing are denoted by like reference designators.

Fig. 2 shows an advantageous principle for applying the invention between a base transceiver station 201 and base station controller 202. In this embodiment of the invention the primary transmission connection is a 2048-kbps wired connection 203 or radio link which are in accordance with the prior art as such. To provide additional and/or redundant transmission capacity both the base transceiver station 201 and base station controller 202 have an ISDN basic-rate connection block 204 with a wired connection to the public switched telephone network (PSTN) 205. If the capacity provided by the wired connection 203 is not enough or connection 203 is for some reason or another cut off, a bi-directional ISDN connection is set up between the basic-rate connection blocks 204 via the public switched telephone network 205. As regards the invention, it is not essential which device initiates the ISDN connection, but in order to arrange the operation in an unambiguous manner it is advantageous that the situations in which a device may take active measures to establish an ISDN connection are specifically defined for both the base transceiver station and base station controller.

Fig. 3a shows a base station subsystem 300 applying the invention. Base transceiver stations 301, 302, 303 and 304 are connected into a ring by means of a known transmission system 305 proper, which may be e.g. a 2048-kbps wired system or a radio link based system and to which a base station controller 306 is also connected. Each base transceiver station and the base station controller has a transmission unit 307 for connection with the transmission system 305 proper. The base transceiver stations also include an ISDN basic-rate connection block 204 through which each base transceiver station may establish an ISDN connection via the public switched telephone network 205. The base station controller 306 includes an ISDN system interface block 308. In the system depicted by Fig. 3a it is possible to establish an

ISDN connection between the base station controller 306 and any base transceiver station 301, 302, 303 or 304 independent of the other base transceiver stations; as the capacity of the ISDN system interface is more than tenfold compared to the capacity of a single ISDN basic-rate connection, it is indeed possible that the base station controller have an ISDN connection with all the base transceiver stations simultaneously.

The invention does not require that all base transceiver stations in a given base station subsystem can establish an ISDN connection. Fig. 3b assumes that base transceiver stations 302 and 303 are located in an area where the occurrence of traffic peaks is more likely than in the area of base transceiver stations 301' and 304', so only base transceiver stations 302 and 303 are equipped with ISDN facilities.

Fig. 4 shows an embodiment of the invention where base transceiver stations 401, 402, 403 and 404 are located far away from base station controller 405. A transmission system 406, which may be a known transmission system, interconnects the base transceiver stations 401, 402, 403 and 404 in a ring system and also comprises a connection from base transceiver station 404 to base station controller 405. That connection is backed up in such a manner that both base transceiver station 404 and base station controller 405 include an ISDN system interface block 308; base transceiver station 404 could also include an ISDN basic-rate connection block. The redundant connection between base transceiver station 404 and base station controller 405 is activated as needed by establishing a communications link via the public switched telephone network 205.

Fig. 5 shows a base transceiver station 500 according to the invention which comprises in a known manner an antenna 501, duplexing unit 502, a plurality of transceiver blocks 503, data bus 504, control block 505 and a transmission unit 506. The latter is used to connect the base transceiver station 500 to the transmission system 507 of the base station subsystem. In accordance with the invention the base transceiver station 500 includes an ISDN basic-rate connection block 508 through which the base transceiver station 500 is connected to the public switched telephone network 509. Since the channels 2 x 64 kbps + 16 kbps of the ISDN basic-rate connection are not necessarily compatible with the cellular radio system's traffic and control channels handled by the transceiver blocks 503 and control block 505, there is between the ISDN basic-rate connection block 508 and data bus 504 a multiplexing block 510 which correctly multiplexes the data of the uplink traffic and control channels, read from the data bus 504, into the ISDN basic-rate channels and, on the

other hand, demultiplexes the downlink traffic and control channel data from the ISDN basic-rate channels and writes them in the correct order to the data bus 504. The read and write order on the data bus 504 as well as the timing of the operation of the various blocks are controlled by the control block 505 which generates the necessary clock pulses. To control the operation of the various blocks the base transceiver station 500 may include one or more control buses (not shown) interconnecting the blocks.

Multiplexing and demultiplexing of channels, realization of channel rate adaptations and the block operation control measures needed in the operation described above are known to a person skilled in the art and are therefore not described in more detail in this patent application. The control block 505 comprises the necessary storage capacity to store either in advance or during the operation in the form of computer program the necessary instructions which the control block 505 executes to carry out its tasks.

Fig. 6 shows a base station controller 600 according to the invention. Block 601 represents all the base station controller components that are needed in the processing of data on the cellular radio system's traffic and control channels and in the controlling of the operation of base transceiver stations in a known manner, including, for example, channel allocation and release, transmission power adjustments, loading control at various base transceiver stations, and handovers. Block 601 has a data connection 602 according to the so-called A interface or Iu interface to a cellular radio system switching center (not shown). Transmission unit 603 connects the base station controller in a known manner to the transmission system 604 of the base station subsystem. In accordance with the invention the base station controller 600 comprises an ISDN interface block 605 which may be a basic-rate connection block or system interface block, depending on how large a capacity is required of the ISDN connection 606. A multiplexing block 607 is responsible for the same or corresponding tasks as the base transceiver station multiplexing block 510 shown in Fig. 5.

Fig. 7 illustrates in the form of a simplified state diagram the method according to the invention which in this form may be applied in both a base transceiver station and base station controller. In the base state 701 communication via the base station subsystem's transmission system proper is normal, i.e. there is enough capacity and the connection is not cut off. Transition to partial ISDN state 702 takes place if the transmission system is functioning faultlessly but the capacity starts to run out. In

the partial ISDN state data are transferred using both the transmission system proper and the ISDN interface, and a transition back to the base state may occur if the amount of data transferred drops. Some sort of hysteresis is advantageously applied to the transitions between states 701 and 702 in order to prevent repeated state transitions back and forth in case the amount of data transferred fluctuates around the limit specifying whether or not the capacity of the transmission system proper suffices. Full ISDN state 703 is taken into use if the connection via the transmission system proper becomes badly disrupted or is cut off. Then all communication will take place via the ISDN connection until the transmission system proper is restored, whereafter the device returns to the base state 701. If the transition to the full ISDN state was made from state 702 and the loading was not reduced during state 703, it is of course possible that having returned to the base state 701 the device very quickly enters the partial ISDN state 702.

If it is desired to apply the invention just to protect a connection against disturbances, it is possible to use a method which is otherwise like that shown in Fig. 7, but excluding state 702 and the transitions to and from it.

Above, the connection according to the invention established via the public switched telephone network was called an ISDN connection. This however does not mean that the invention cannot just as well be applied to other digital communications links routed via the public switched telephone network. At the moment of this writing, the ISDN is probably the most advantageous option available. The embodiments described above do not limit the invention but are presented so as to provide examples of possible applications of the invention. One modification within the scope of the invention is a system in which a base transceiver station may establish a connection with a base station controller of an entirely other base station subsystem if its own base station controller becomes faulty or suffers from limited functionality.

Claims

1. A telecommunication apparatus (500, 600) of a base station subsystem to be used in a cellular radio system's base station subsystem which comprises
- as telecommunication apparatus, base transceiver stations (201, 301, 302, 303, 304, 301', 304', 401, 402, 403, 404) and a base station controller (202, 306, 405) and
- a transmission system (203, 305, 406) to realize data communication between the telecommunication apparatus,
which telecommunication apparatus comprises a transmission unit (307, 506, 603) to connect it to a transmission system,
characterized in that it also comprises an interface (204, 308, 508, 605) to a public switched telephone network (205, 509) to realize data communication via the public switched telephone network between it and a second telecommunication apparatus in the base station subsystem, whereby, as regards the data communication between these two telecommunication apparatus, the telecommunication apparatus is adapted so as to operate in at least two mutually alternative states (701, 702, 703) in the first of which (701) the connection via the public switched telephone network between it and the second telecommunication apparatus in the base station subsystem is not in use, and in the second state of which (702, 703) the connection via the public switched telephone network between it and the second telecommunication apparatus in the base station subsystem is in use.

2. A telecommunication apparatus according to claim 1, **characterized** in that said interface (204, 308, 508, 605) to a public switched telephone network (205, 509) is an ISDN interface.

3. A telecommunication apparatus according to claim 2, **characterized** in that said interface to a public switched telephone network (205, 509) is an ISDN basic-rate interface (204).

4. A telecommunication apparatus according to claim 2, **characterized** in that said interface to a public switched telephone network (205, 509) is an ISDN system interface (308).

5. A telecommunication apparatus according to claim 1, **characterized** in that it also comprises a multiplexing block (510, 607) to make adaptations between the traffic and control channels of the cellular radio system and traffic and control channels of the public switched telephone network.

6. A telecommunication apparatus according to claim 1, **characterized** in that it is a base transceiver station (500).

7. A telecommunication apparatus according to claim 1, **characterized** in that it is a base station controller (600).

8. A base station subsystem in a cellular radio system, comprising
- as telecommunication apparatus, base transceiver stations (201, 301, 302, 303, 304, 301', 304', 401, 402, 403, 404) and a base station controller (202, 306, 405) and
- a transmission system (203, 305, 406) to realize data communication between the telecommunication apparatus,
where each telecommunication apparatus comprises a transmission unit (307, 506, 603) to connect it to a transmission system,
characterized in that it comprises in at least two telecommunication apparatus an interface (204, 308, 508, 605) to a public switched telephone network (205, 509) in order to realize data communication between these two telecommunication apparatus, whereby these two telecommunication apparatus, as regards their mutual communication, are adapted so as to function in at least two mutually alternative states (701, 702, 703) in the first of which (701) a connection between these two telecommunication apparatus via the public switched telephone network is not in use, and in the second state of which (702, 703) a connection between these two telecommunication apparatus via the public switched telephone network is in use.

9. A base station subsystem according to claim 8, **characterized** in that it comprises in at least two telecommunication apparatus an ISDN interface (204, 308, 508, 605).

10. A base station subsystem according to claim 9, **characterized** in that it comprises in at least one base transceiver station and in the base station controller an ISDN basic-rate interface (204).

11. A base station subsystem according to claim 9, **characterized** in that it comprises in at least one base transceiver station an ISDN basic-rate interface (204) and in the base station controller an ISDN system interface (308).

12. A base station subsystem according to claim 9, **characterized** in that it comprises in at least one base transceiver station and in the base station controller an ISDN system interface (308).

13. A method for realizing data communication in a cellular radio system's base station subsystem which comprises

- as telecommunication apparatus, base transceiver stations (201, 301, 302, 303, 304, 301', 304', 401, 402, 403, 404) and a base station controller (202, 306, 405) and

- a transmission system (203, 305, 406) to realize data communication between the telecommunication apparatus,

where each telecommunication apparatus comprises a transmission unit (307, 506, 603) to connect it to a transmission system,

characterized in that the functional state of the mutual communication of at least two telecommunication apparatus is switched between at least two mutually alternative states (701, 702, 703) in the first of which (701) there is no communications link between these two telecommunication apparatus via a public switched telephone network, and in the second of which (702, 703) there is a communications link between these two telecommunication apparatus via a public switched telephone network.

14. A method according to claim 13, **characterized** in that said two telecommunication apparatus are a base transceiver station and base station controller, whereby

- in the first state (701), data are transferred between the base transceiver station and base station controller via the transmission system but not via the public switched telephone network, and

- in the second state (702), data are transferred between the base transceiver station and base station controller both via the transmission system and via the public switched telephone network,

whereby the transition from the first state to the second state occurs in response to an observation indicating that the amount of data transferred via the transmission system exceeds a certain first limit value, and the transition from the second state to the first state occurs in response to an observation indicating that the total amount of data transferred via the transmission system and public switched telephone network remains below a certain second limit value.

15. A method according to claim 13, **characterized** in that said two telecommunication apparatus are a base transceiver station and base station controller, and their mutual communication also comprises a third functional state (703), whereby

- in the first state (701), data are transferred between the base transceiver station and base station controller via the transmission system but not via the public switched telephone network,

- in the second state (702), data are transferred between the base transceiver station and base station controller both via the transmission system and via the public switched telephone network, and
- in the third state (703), data are transferred between the base transceiver station and base station controller via the public switched telephone network but not via the transmission system,

whereby

- transition from the first state to the second state occurs in response to an observation indicating that the amount of data transferred via the transmission system exceeds a certain first limit value,
- transition from the second state to the first state occurs in response to an observation indicating that the total amount of data transferred via the transmission system and public switched telephone network remains below a certain second limit value,
- transition to the third state occurs in response to an observation indicating that data transfer via the transmission system is disrupted, and
- transition from the third state to the first state occurs in response to an observation indicating that data transfer via the transmission system has been restored.

16. A method according to claim 13, **characterized** in that said two telecommunication apparatus are a base transceiver station and base station controller, whereby

- in the first state (701), data are transferred between the base transceiver station and base station controller via the transmission system but not via the public switched telephone network, and
- in the second state (703), data are transferred between the base transceiver station and base station controller via the public switched telephone network but not via the transmission system,

whereby

- transition from the first state to the second state occurs in response to an observation indicating that data transfer via the transmission system has been disrupted, and
- transition from the second state to the first state occurs in response to an observation indicating that data transfer via the transmission system has been restored.

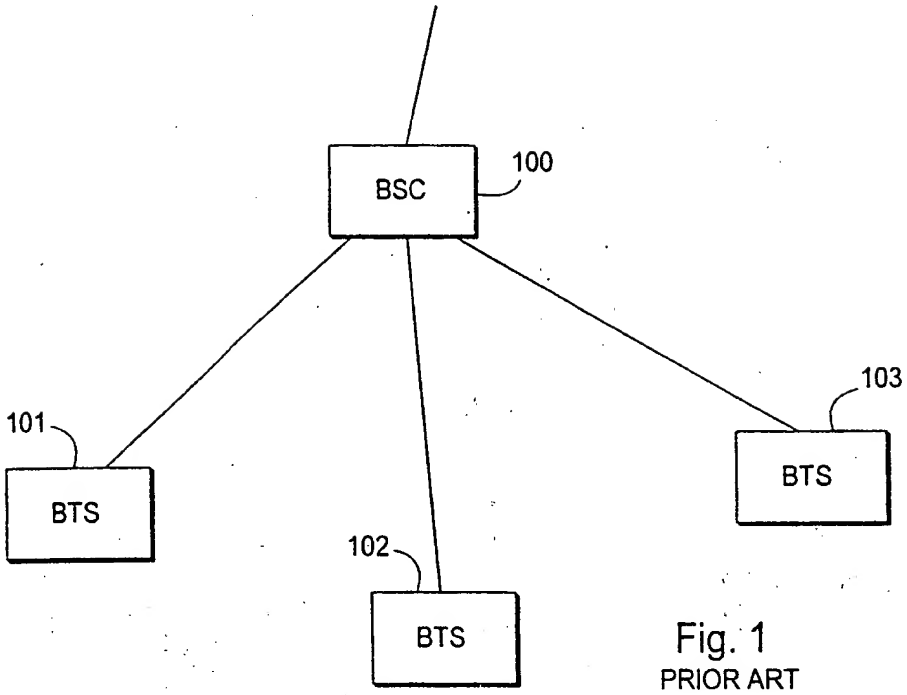


Fig. 1
PRIOR ART

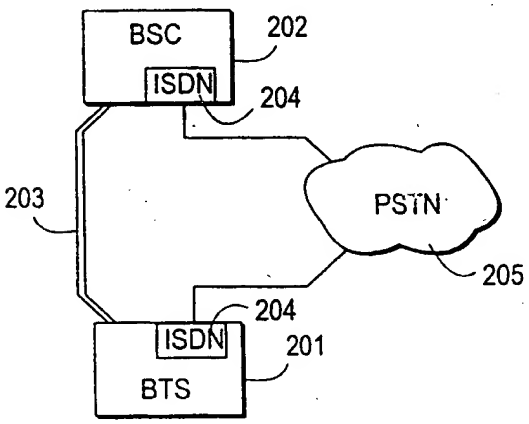
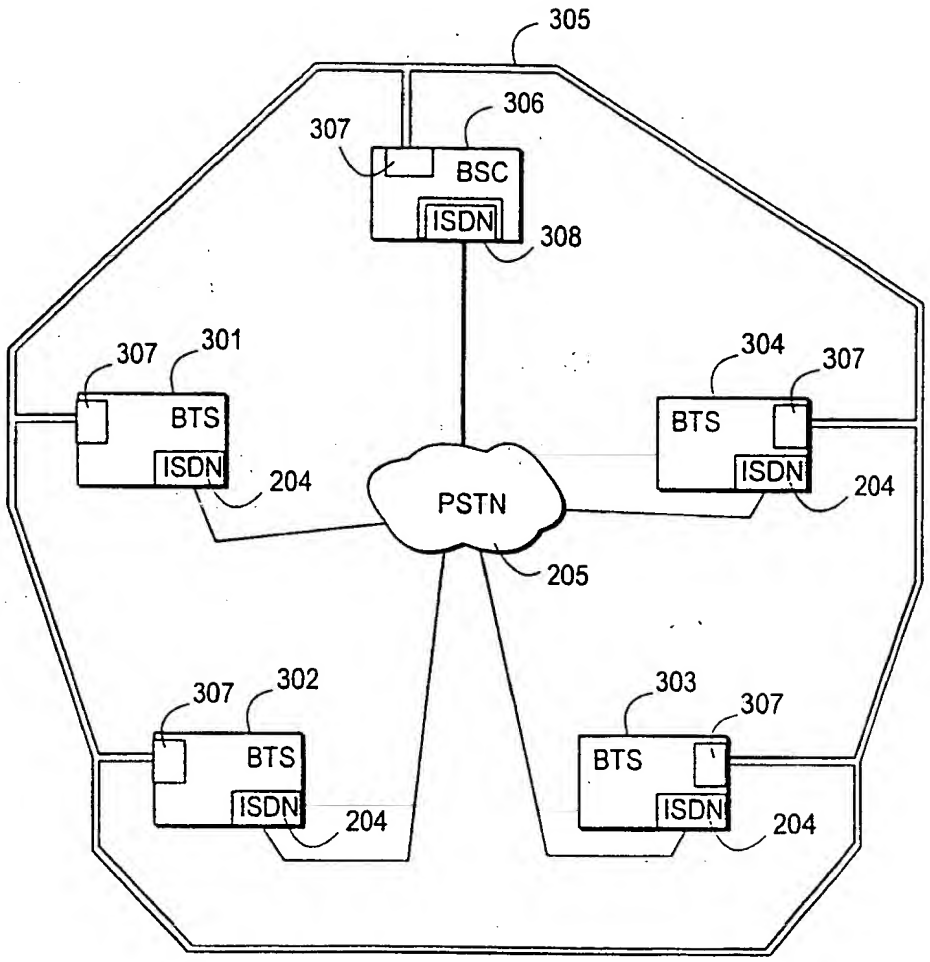


Fig. 2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ISDN
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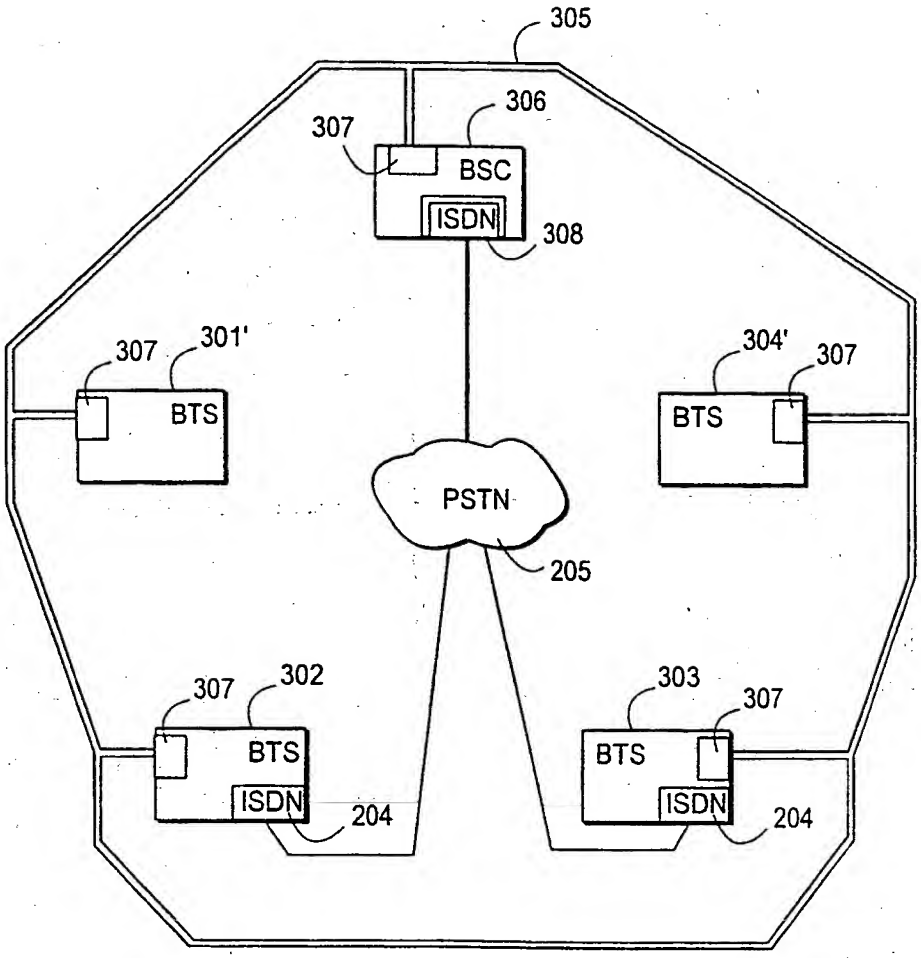
307
301
BTS
ISDN
204
304
307
BTS
ISDN
204
PSTN
205
307
302
BTS
ISDN
204
303
307
BTS
ISDN
204

Fig. 3a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306
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ISDN
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307
301'
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304'
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PSTN
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302
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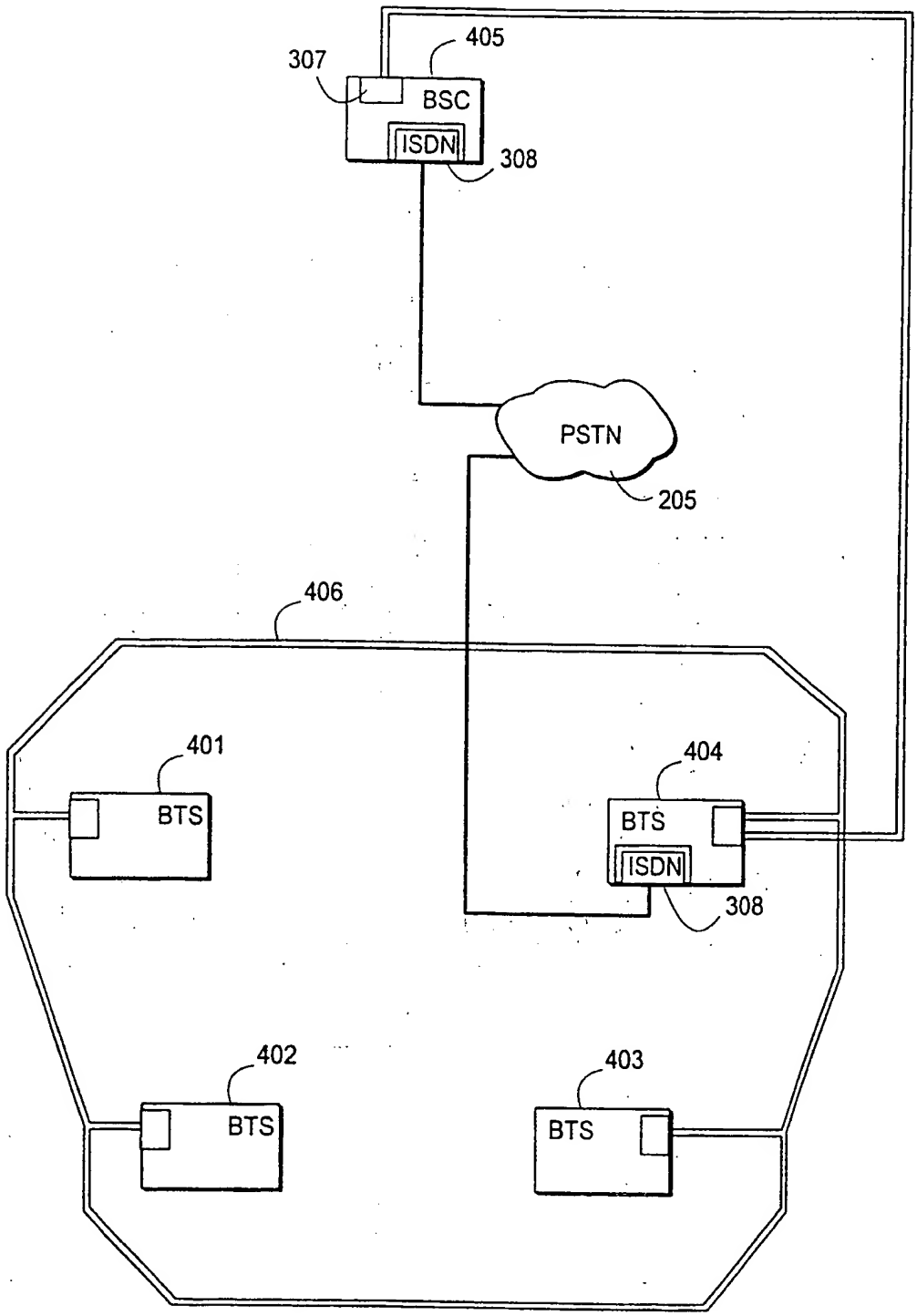
ISDN
204
303
307
BTS
ISDN
204

Fig. 3b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ISDN
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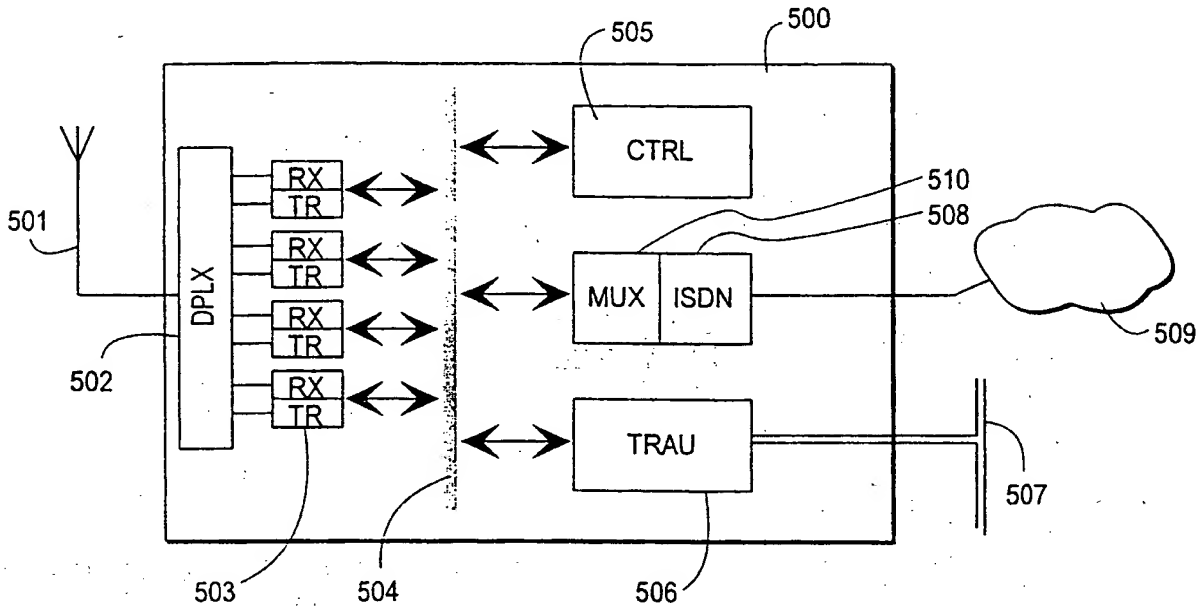
403
BTS

Fig. 4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RX
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RX
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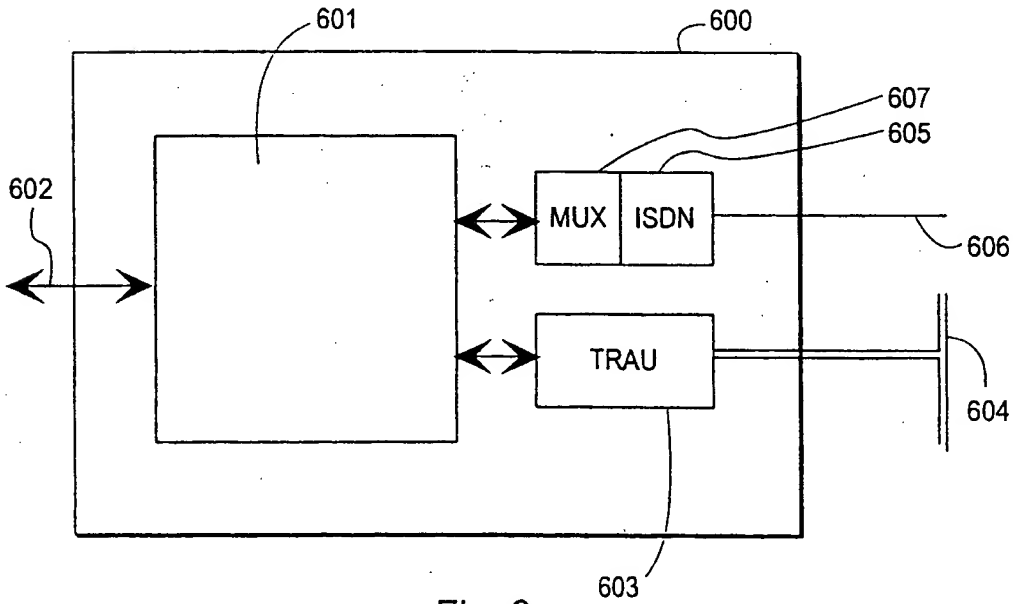
TRAU
507
503
504
506

Fig. 5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MUX
ISDN
606
TRAU
604
603

Fig. 6

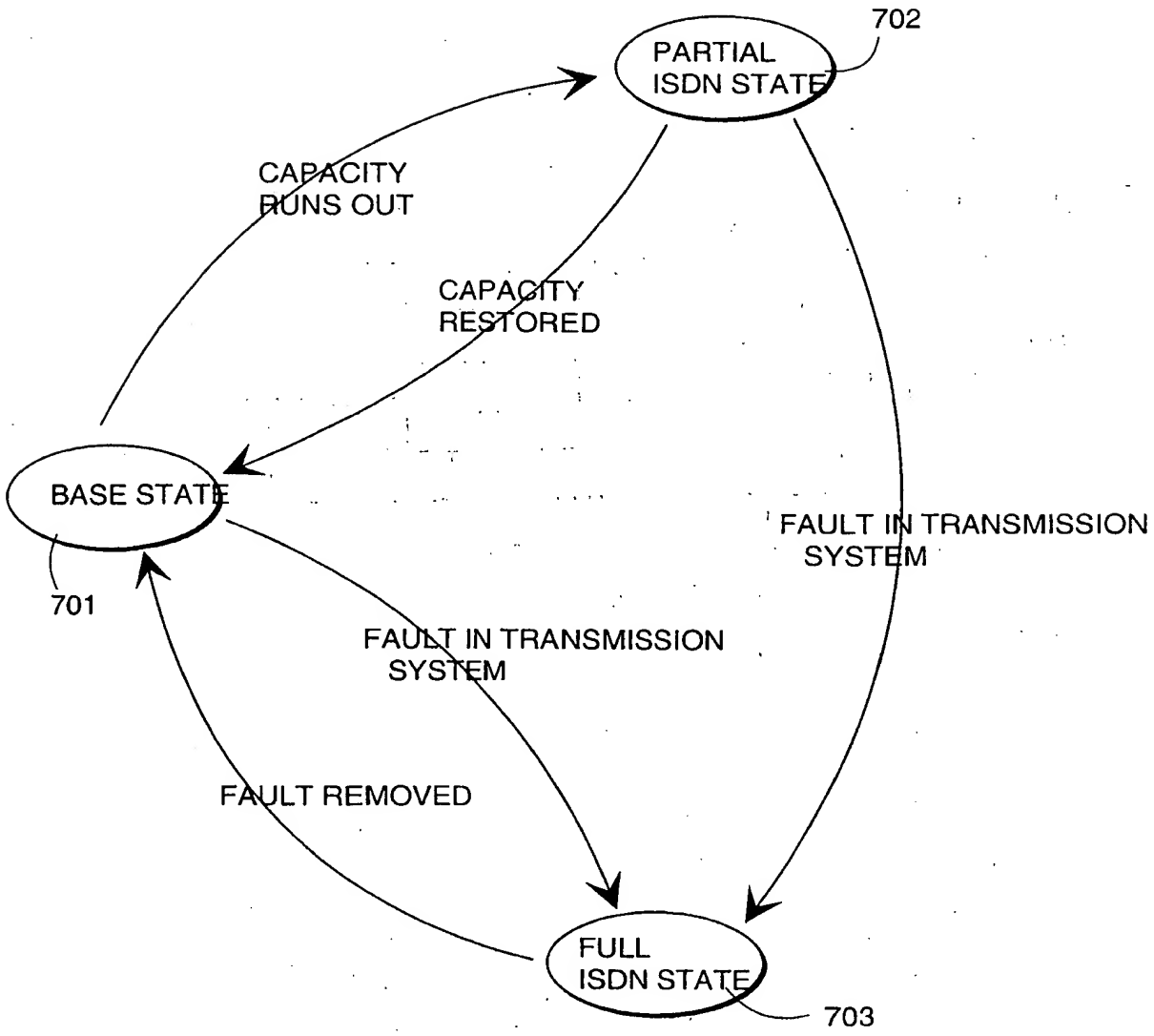
PARTIAL ISDN STATE
702
CAPACITY RUNS OUT
CAPACITY RESTORED
BASE STATE
701
FAULT IN TRANSMISSION SYSTEM
FAULT IN TRANSMISSION SYSTEM
FAULT REMOVED
FULL ISDN STATE
703

Fig. 7

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International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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A3

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(74) Agent: BERGGREN OY AB; P.O. Box 16, FIN–00101 Helsinki (FI).

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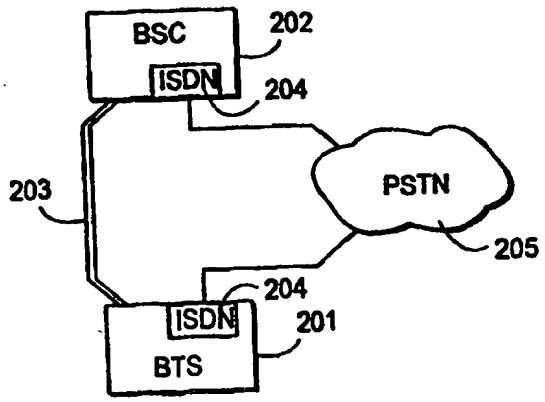
(54) Title: IMPLEMENTATION OF ADDITIONAL AND/OR BACKUP CAPACITY IN BASE STATION TRANSMISSION

(57) Abstract

A base station subsystem in a cellular radio system comprises as telecommunication apparatus base transceiver stations (201, 301, 302, 303, 304, 301', 304', 401, 402, 403, 404) and a base station controller (202, 306, 405) as well as a transmission system (203, 305, 406) to realize data communication between the telecommunication apparatus. A telecommunication apparatus comprises a transmission unit (307, 506, 603) to connect it with the transmission system. It also comprises an interface (204, 308, 508, 605) to a public switched telephone network (205, 509) in order to realize data communication between it and a second telecommunication apparatus in the base station subsystem via the public switched telephone network. The telecommunication apparatus is adapted so as to operate in at least two mutually alternative states (701, 702, 703) with respect to the communication between it and the second telecommunication apparatus. In the first state (701) a connection via the public switched telephone network between said two telecommunication apparatus in the base station subsystem is not in use, and in the second state (702, 703) a connection via the public switched telephone network between said two telecommunication apparatus in the base station subsystem is in use.



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INTERNATIONAL SEARCH REPORT

International application No.
PCT/FI 99/00165

A. CLASSIFICATION OF SUBJECT MATTER

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According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

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Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 9704615 A1 (GOETZ, IAN), 6 February 1997 (06.02.97), page 1, line 19 - page 3, line 5; page 7, line 27 - page 8, line 19, figure 2, claims 1,6,7 --	1-4,6-14
A	WO 9519095 A1 (NOKIA TELECOMMUNICATIONS OY), 13 July 1995 (13.07.95), page 2, line 32 - page 4, line 15, claims 1-3 --	1,8,13
A	WO 9724008 A1 (BRITISH TELECOMMUNICATIONS PUBLIC LIMITED COMPANY), 3 July 1997 (03.07.97), page 2, line 26 - page 3, line 5; page 4, line 3 - line 18; page 7, line 33 - page 9, line 25, figure 2 --	1,8,13

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Date of the actual completion of the international search	Date of mailing of the international search report
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INTERNATIONAL SEARCH REPORT

International application No.
PCT/FI 99/00165

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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A	WO 9712492 A1 (TELEFONAKTIEBOLAGET LM ERICSSON), 3 April 1997 (03.04.97), page 4, line 16 - page 6, line 4	1,8,13

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Information on patent family members

02/08/99

International application No.
PCT/FI 99/00165

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